PC Enterprises'

Xtra-K EMS and Xtra-K EMS-Plus ISAcards

Installation and Operation Manual #80101-1

PC Enterprises' Xtra-K EMS ISAcard allows you to add up to 64MB of EMS (expanded) memory to your computer.

The Xtra-K EMS-Plus ISAcard allows computers with CGA or TGA video adapters to increase conventional memory from 512KB or 640KB to 736KB. Computers with TTL monochrome adapters can be expanded to 704KB. In addition, up to 64MB of EMS (Expanded) memory can be added , and 64KB of UMB memory. To use the UMB feature your computer must use DOS 5.0 (or later) and your computer must have the E000 segment available.

If you are an experienced PC user, you may refer to the "**APPENDIX B: EXPERIENCED USERS' GUIDE TO INSTALLATION**" section to quickly install your Xtra-K EMS or Xtra-K EMS-Plus ISAcard.

INTRODUCTION

General

In order for a computer to run a program, the computer must have adequate memory. Memory used to run programs is referred to as conventional memory. If a computer does not have enough conventional memory to run a program, the program simply will not run.

Expanded memory is another type of memory. If a program is designed to use expanded memory the program's manual or package normally states the amount of expanded memory required to run the program.

UMB memory is memory that can be addressed in one of the computer's Upper Memory Blocks. Computers that have UMB memory can run device drivers and other TSR programs without using conventional memory.

Computer memory is normally measured in Kilobytes (KB) or Megabytes (MB). One Kilobyte (KB) is equal to 1024 bytes, and one Megabyte equals 1024 Kilobytes. Consequently, a computer that has 640KB of conventional memory actually has 655,536 bytes of memory.

Conventional Memory

The memory that most people are familiar with using on their PCs is known as "conventional" memory. This is the memory that is associated with 640KB of memory. Conventional memory is the first memory on the PC to be used when programs are loaded. In reality, the amount of available memory after DOS loads is less than the total amount of conventional memory physically installed in your PC. You can verify this fact by running the CHKDSK program supplied with DOS. In addition to reporting disk information, CHKDSK also displays "total bytes memory" (installed conventional) and "bytes free" (available to programs). Unfortunately, IBM compatible computers were designed with a limitation that prevents them from having an unlimited amount of conventional memory.

The maximum amount of conventional memory that an IBM compatible computer can have is determined by the video adapter installed. Computers that have CGA or TGA (Tandy) video adapters can have 736KB of conventional memory, while computers with monochrome adapters can only have 704KB. Computers that have VGA or EGA video adapters installed are limited to 640KB. As a result of these limitations, 640KB is often referred to as the limitation of conventional memory.

Expanded Memory Specification 3.2

Expanded memory is a type of memory used by many programs that need more than 640KB. The Expanded Memory Specification (EMS) was developed primarily by three companies working together: Lotus, Intel, and Microsoft (LIM). Software designed to use expanded memory is therefore known as "LIM EMS compatible". The Expanded Memory Specification was not widely used by software publishers until EMS version 3.2 was developed. LIM EMS 3.2 allowed computers to have as much as 32MB of EMS memory in addition to the 640KB of conventional memory. In order for EMS memory expansion boards to implement EMS compatibility, software known as an Expanded Memory Manager (EMM) must be executed.

How Expanded Memory (EMS 3.2) Works

As a computer user, you will not need to be concerned with how EMS works. The EMM software provided (EMS-XK.SYS) takes care of all the details automatically.

To understand how expanded memory works you must first know that the original IBM PC has a total memory address range of 1 Megabyte. The first 640KB of this address space is used for conventional memory with the following 384KB reserved for current and future video adapters, optional adapter ROM, and system board ROM. EMS 3.2 uses four independent physical page frames in a portion of the space reserved for optional adapter ROM.

To understand a physical page frame is, think of how a book is organized. You might read a very large book, however you never use more than one page at a time. Version 3.2 of the LIM Expanded Memory Specification allows four pages of memory to be used allowing programs to access any four sections of expanded memory at any given time.

In order for a program to take advantage of EMS it must be designed to use EMS. Many, but not all programs use EMS. Those programs that do not take advantage of EMS usually are small and do not need more memory than the amount provided by conventional memory.

Expanded Memory Specification 4.0

Later, as the PC community found the EMS 3.2 standard very useful, EMS 4.0 was developed. Virtually all software developed to use LIM EMS 3.2 will work with LIM EMS version 4.0 without modification. LIM EMS 4.0 has many more features available to programs than LIM EMS 3.2 did and also has lifted some restrictions imposed by LIM EMS 3.2. LIM EMS 4.0 is the most widely used expanded memory standard. Virtually any program claiming LIM EMS compatibility will be able to use the Xtra-K cards.

Those that use DOS 5.0 (or later) have yet another reason to install an Xtra-K EMS ISAcard and use LIM 4.0 Expanded Memory. DOS 5.0 itself can take advantage of expanded memory, which means adding expanded memory will provide significantly improved performance when application software is run. Refer to the SMARTDRV, RAMDRIVE, and FASTOPEN commands in the DOS 5.0 manual for additional information.

Expand Beyond EMS Limitations

The LIM Expanded Memory Specification 4.0 imposes a limit of 32MB. The Xtra-K cards actually exceed the LIM Expanded Memory Specification by providing up to 64MB of EMS memory instead of 32MB. Although you may not have a need for this much memory at present, due to the ever-increasing memory requirements of new programs and falling memory prices, you may find this feature practical and economical sometime in the future. Remember that years ago 640KB seemed like more memory than anyone would ever need.

Using Conventional and EMS Memory

Many of today's programs need as much conventional memory as possible. Available conventional memory is precious and should be conserved when ever possible. Even with a considerable amount of EMS memory, if the amount of available conventional memory is somewhat small, it may become a limiting factor and prevent you from running large programs. The Xtra-K EMS-Plus ISAcard allows you to expand the amount of conventional memory beyond the usual limit of 640KB. This feature ensures you will always have enough conventional memory.

Loosing Available Conventional Memory to DOS

The amount of conventional memory your computer has available is affected by the size of the DOS installed. DOS loads in conventional memory and continues to occupy a portion of conventional memory once loaded. DOS 2.11 uses the smallest amount of conventional memory (approximately 24KB) while DOS 4.00 the largest (over 64KB).

Loosing Conventional Memory to Programs

In addition to DOS residing in conventional memory, the amount of available conventional memory is further reduced when TSR (Terminate and Stay Resident) programs are also used. TSR programs are programs that continue to use conventional memory (and run in the background) after they are initially loaded. TSR programs are among the most useful programs and are often required for certain tasks. Many TSR programs can be used at the same time. DOS, itself, comes with many

TSR programs. Examples are mouse drivers, ramdisk programs and hard drive caches as well as popular application software such as Sidekick and Superkey.

Tandy PCs that Use TGA

Tandy's 1000 series of PCs uses a CGA compatible video adapter called TGA (Tandy Graphics Adapter). While TGA does provide better video capabilities when compared to CGA, TGA uses conventional memory for video purposes. Tandy PCs that have 640KB and TGA therefore have less than 640KB of conventional memory and therefore have less memory than a comparable IBM PC. Certain Tandy PCs that use TGA also have built-in monochrome graphics known as THGA (Tandy Hercules-compatible Graphics Adapter). The Xtra-K EMS-Plus ISAcard provides video memory when used with Tandy computers that have TGA or THGA. In addition the full amount of conventional memory installed becomes usable for DOS and programs. This feature of the Xtra-K EMS-Plus ISAcard is known as TGA (or THGA) backfilling. The Xtra-K EMS-Plus ISAcard therefore allows Tandy computers to have the same amount of conventional memory as a normal PC-or even more! (Keep reading).

Tandy PCs With 768KB of Memory

Some Tandy PCs also are installed with 768KB of memory. Unfortunately, despite their deceiving appearance, these computers have no more conventional memory than a normal 640KB PC. The extra 128KB on these machines is used for video memory. While the additional video memory is never required to run IBM compatible software, it does allow the computer to have a full 640KB available for DOS and application software. Regardless of whether your Tandy PC has 640KB or 768KB, if you are using TGA or THGA graphics the Xtra-K EMS-Plus ISAcard will provide much more memory than what you already have.

Expand Conventional Memory Beyond 640KB

The addresses reserved for future video adapters are adjacent to the 640KB used for conventional memory. Systems with CGA or TGA have 96KB of unused address space on top of conventional memory while monochrome users (MDA and HGA) have 64KB. The Xtra-K EMS-Plus ISAcard is capable of placing memory in this otherwise unused address space and because the memory is "contiguous" the computer and DOS can use it. The future video address space later became used by EGA (Enhanced Graphics Adapter) and VGA graphics adapters so users with these features are unable to increase conventional memory beyond 640KB.

Extended Memory

With the introduction of the 286 processor in the IBM PC AT, another type of memory known as extended became available. The 286 processor has a total memory address range of 16MB. With a 286 processor the first 1MB of its address space is identical to that of the original IBM PC in order to remain downwardly compatible, but the remaining 15MB of address space can be used for what is called "extended" memory. As a result, 286 computers can not have more than 15MB of extended memory. The Xtra-K ISAcards allow more than four times this amount to be added as EMS memory. The EMS memory you add can be in addition to, or instead of, extended memory. It is impossible to have extended memory on a pre-286 computer, because all pre-286 computers can not address memory above 1MB. A computer does not have to address memory above 1MB in order to use EMS.

XMS Memory

EMS promises to be a mature and indispensable standard because EMS can be used in all generation PCs, programs widely in use throughout the industry are already designed for EMS, and, with the Xtra-K cards, EMS can provide as much as 64MB of memory. A memory standard has been developed for the management of extended memory. This extended memory standard known as XMS (eXtended Memory Specification) is like the EMS standard used for expanded memory. The program named HIMEM.SYS implements the XMS standard and is known as the extended memory manager (XMM). HIMEM.SYS is provided by Microsoft and has been supplied with some versions of DOS and Windows. Currently, many more programs use EMS (Expanded) memory than programs that use XMS (Extended) memory. Users of computers that already have extended memory therefore often install the Xtra-K cards to provide EMS memory.

HMA Memory

In addition to providing XMS support, HIMEM.SYS also has another function. There is an idiosyncracy inherent to all processors capable of addressing more than 1MB. By providing control over the processor's A20 line, 286 processors can take advantage of this idiosyncracy to provide nearly 64KB of extended memory that can be used by DOS. This memory is known as the HMA (High Memory Area). The HMA can only be used by one program at a time, but very few programs have ever used this memory. DOS 5.0 uses the HMA by loading a portion of itself there. This makes more conventional memory available when running DOS 5.0, but only on PCs that have extended memory and have control over the A20 line.

The 386 Processor

After the 286 processor was used in many PCs, the 386 processor was introduced. The 386 processor is a faster and more efficient processor than the 286, but, most importantly, it was endowed with special memory management features that allow software to have more control over the arrangement of the PC's memory. It is these special memory management features that give the 386 processor an advantage over its predecessors. The Xtra-K EMS-Plus ISAcard provides hardware that compensates for this advantage and therefore allows 8088, 8086, and 286 computers to run software that would otherwise require a 386 processor.

UMB Memory

Even with an abundance of EMS or XMS memory available on a particular PC, the amount of conventional memory can still be rather small. To help alleviate this problem, Microsoft DOS 5.0 (and equivalent) allows unused segments of the PC to have memory that can be used for DOS programs. DOS 5.0 uses a program called EMM386.EXE to provide UMB memory. The EMM386.EXE program is considered the "provider" of the memory used as a UMB because it programs the 386 processor to move an amount of XMS memory to a memory address that DOS can access. UMB memory can reduce the amount of conventional memory used by TSR programs. After EMM386.EXE has provided the memory, DOS's HIMEM.SYS provides the management of the UMB memory. The EMM386.EXE program can also convert extended memory into expanded memory because more programs currently use expanded rather than extended memory. Unfortunately, if you have an 8088, 8086, or 80286 processor, DOS 5.0's EMM386.EXE will not work on your computer.

The Xtra-K EMS-Plus ISAcard is capable of being the "provider" of the memory used as a UMB. This means that you do not need the special memory management features of a 386 processor in order to use UMB memory! The Xtra-K EMS-Plus ISAcard, combined with its software, provides the UMB memory management features of HIMEM.SYS and the "provider" features of EMM386.EXE.

Xtra-K EMS ISAcard Features

Provides EMS memory in addition to any conventional memory

Allows two to eight times the amount of EMS memory installed on competitive EMS products

Allows much more EMS memory than the Expanded Memory Specification versions 3.2 and 4.0 permit

Provides over four times more memory than the maximum amount of extended memory on a 286 based PC

Works in Tandy brand PCs that can not use typical memory expansion products

Xtra-K EMS-Plus ISAcards provide all features of the Xtra-K EMS ISAcard PLUS:

Increases the amount of available conventional memory by as much as 96KB by increasing the total amount of conventional memory

Frees up to 64KB of conventional memory used by TSR programs by providing UMB memory for these programs

Restores the conventional memory taken away by the TGA video adapter

ABOUT THE HARDWARE

The Xtra-K EMS-Plus ISAcard provides all the features of the Xtra-K EMS ISAcard, but also adds the capabilities of having more than 640KB of conventional DOS memory, an extra 64KB of UMB memory, and the ability to expand 512KB computers to 640KB.

The design of the Xtra-K cards allow different decode modules to be installed. Each decode module will allow the Xtra-K cards to select a different combination of memory locations to use for its features. If the current decode modules included with your Xtra-K card do not suit your particular PC, contact PC Enterprises for the appropriate decode module and switch settings for your particular PC.

It is not possible to use the PC Enterprises Xtra-K ISAcards at the same time as one another. If you are installing the Xtra-K card and currently have another EMS product in your PC, please remove or disable the other EMS product before installing the Xtra-K card. If your other EMS product uses industry standard SIMMs, it is likely that the SIMMs can be installed into the Xtra-K card.

The Xtra-K cards were designed for fast zero wait state memory access. A wait state switch has been incorporated into the design of the Xtra-K cards to allow for future compatibility. PC Enterprises recommends that 100ns (or faster) SIMMs be used in the Xtra-K ISAcards. You may use SIMMs that have faster access time ratings than 100ns, however faster SIMMs should not provide any advantage.

SIMMs are currently available in 256KBx8 (pronounced "two-fifty-six kilobyte by eight") , 256KBx9, 1MBx8 (pronounced "one-megabyte by eight"), 1MBx9, 4MBx8, 4MBx9, 16MBx8, and 16MBx9 sizes. When used in the Xtra-K cards, a "x9" SIMM offers no advantage and is usually more expensive than its "x8" counterpart. The Xtra-K cards are designed to work with x9 SIMMs because x9 SIMMs are more popular and are commonly used by other products.

To install SIMMs into the Xtra-K cards, all you need to do is plug each module into any of the four SIMM sockets. The Xtra-K cards will automatically detect which sockets hold SIMMs and what size each are. There is no need for the Xtra-K card to detect each SIMM's speed rating.

The Xtra-K cards are designed to be fully compatible with all computers that use the ISA (Industry Standard Architecture) 8-bit expansion slot. This also includes Tandy PCs that normally do not allow IBM PC compatible memory expansions to work with their design.

INSTALLATION

STEP ONE: Take Certain Precautions

Before installing any hardware into your PC, make certain that the PC is currently operating correctly and that it is capable of booting DOS without any problems. These instructions assume that your PC works as it should before the Xtra-K card is installed.

Depending on how your system is configured and whether you have an Xtra-K EMS-Plus ISAcard or Xtra-K EMS ISAcard, you may need to configure your DOS to use one or more device driver programs included. In either case precautionary measures are necessary to ensure that you will be able to recover and continue to use your computer, if a problem is encountered.

Hard Drive Users

If your computer boots DOS from a hard drive, make a backup copy of your CONFIG.SYS file and also format a DOS boot diskette in drive A:. Example (if your hard drive is C:):

```
COPY C:\CONFIG.SYS C:\CONFIG.OLD

FORMAT A: /S
```

Floppy Drive Users

If your computer boots DOS 5.0 from a floppy drive, make a DISKCOPY of the diskette you use to boot with and save the original DOS boot diskette as a backup copy. Use the new copy to install your Xtra-K software. Example:

```
DISKCOPY A: A:
```

STEP TWO: Setting the ROM BIOS Address

The Xtra-K EMS ISAcard does not have a ROM BIOS. If you do not have the Xtra-K EMS-Plus ISAcard, disregard this step.

The Xtra-K EMS-Plus ISAcard uses 16KB of address space for it's on-board ROM BIOS code. The address range of C000-CFFF on all personal computers is reserved for ROM BIOS of optional adapters. The Xtra-K EMS-Plus ISAcard can be addressed in any of eight different locations in the C000-CFFF address range as long as it does not conflict with other optional adapters that you may have already installed.

Locate J2 on the board. J2 has eight pairs of pins with one plastic clip known as a jumper connecting one pair of pins. Each pair is identified by printing on the board that corresponds to the starting address for the Xtra-K EMS-Plus ISAcard's ROM. Choose a location that is not already occupied by other optional adapters you may have installed. PC Enterprises has found that on most personal computer systems, the CE00-CFFF address range is often available. Norton Utilities "System Information" programs and similar software products (i.e. Manifest) can be used to help you determine an address that will not conflict with other hardware already installed in your computer.

PINS	ADDRESS
C0	C000-C1FF 1
C2	C200-C3FF 2
C4	C400-C5FF 3
C6	C600-C7FF 4
C8	C800-C9FF 5
CA	CA00-CBFF 6
CC	CC00-CCFF 7
CE	CE00-CFFF 8

VIDEO ROM UNAVAILABLE

32K

64K

16

16

5-21-03 — 3-25-19

3-7-19

If you have the EMS-Plus ISAcard, refer to Step Three and skip Step Four. If you have the EMS ISAcard, skip to Step Four now.

STEP THREE: Switch Settings for the Xtra-K EMS-Plus ISAcard

Use the information in the following three tables if you are adding EMS memory and have a minimum of 640KB of conventional memory. If your PC does not meet these requirements, please contact PC Enterprises for the appropriate switch settings.

There are eight switches located at the edge of the card that allow you to configure the Xtra-K EMS-Plus ISAcard so that it may co-reside with other adapters in your PC.

Note: Component manufacturers often label their switches differently. This manual refers to switch positions as "ON" and "OFF". If your switches are labelled "CLOSED" and "OPEN", then consider "CLOSED" to be "ON" and "OPEN" to be "OFF".

The switch settings for the Xtra-K EMS-Plus ISAcard depend upon the type of video adapter installed in your PC, not the type of monitor used with the adapter. You must identify the type of video adapter your PC uses (example: CGA, TGA, EGA, VGA).

The following table refers to PCs that use digital (TTL) monochrome monitors. If your computer uses a monochrome monitor, determine how many pins are used on the connector that plugs into the rear of your PC. If the connector is a 9-pin D-shell connector then you have a digital monitor. If your monitor uses a single pin cable it is likely that your computer uses a CGA adapter.

USING TTL MONO	NOTE	MODULE	1	2	3	4	5	6	7	8
IBM PC, XT	1	59357	OFF	ON	ON	ON	OFF	ON	ON	OFF
IBM AT, AT Compatible	10	59357	OFF	ON	OFF	ON	OFF	ON	ON	OFF
Tandy 1000 or 1000 A	2	59368	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Tandy 1000 SX	2	59368	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Tandy 1000 TX	3	59357	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Tandy 1000 SL (THGA)	3	59357	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Tandy 1000 TL (THGA)	3	59357	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Tandy 1000 SL/2 (THGA)	3	59357	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Tandy 1000 TL/2 (THGA)	3	59357	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Tandy 1000 RL (THGA)	3	59357	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Tandy 1000 TL/3 (THGA)	3	59357	OFF	ON	OFF	ON	OFF	OFF	ON	OFF

Please make sure the proper module for the switch settings you will be using is installed at U13. See **APPENDIX A** regarding the NOTE column for technical details of the configurations in the table.

MODULE = 59357-V5389

If your PC uses a color monitor, check to see how many pins are used on its connector that plugs into the rear of your PC. If the connector is a 15-pin D-shell connector then your computer uses a VGA adapter and you should refer following table. If the connector is a 9-pin D-shell connector then you need to determine if your computer uses an EGA or CGA/TGA video adapter. Refer to the documentation that came with your PC or video adapter, to determine which video adapter your PC uses. If your PC uses EGA then refer to the table below. If your PC uses CGA or TGA refer to the table for "COMPUTERS USING CGA OR TGA".

3-7-19

OLD

EMS
UMB

USING VGA/EGA	NOTE	MODULE	1	2	3	4	5	6	7	8
IBM PC, XT ✓ YES	4	59357	OFF	ON	ON	OFF	OFF	ON	OFF	OFF ✓
IBM AT, AT Compatible	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 SX	4	59357	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
Tandy 1000 TX	5	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 SL	5	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 TL	5	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 SL/2	5	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 TL/2	5	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 RL	5	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 TL/3	5	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 RLX	5	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF

Please make sure the proper module for the switch settings you will be using is installed at U13. See **APPENDIX A** regarding the NOTE column for technical details of the configurations in the table.

If your PC uses a color monitor such as the IBM Personal Computer Color Display, Tandy CM-11, Tandy CM-5, or equivalent, then your PC most likely uses CGA or TGA and you should refer to the table below.

USING CGA/TGA	NOTE	MODULE	1	2	3	4	5	6	7	8
IBM PC, XT	6	59357	OFF	ON	ON	ON	ON	ON	OFF	ON
IBM AT, AT Compatibles	11	59357	OFF	ON	OFF	ON	ON	ON	ON	ON
Tandy 1000 or 1000 A	7	59357	OFF	ON	ON	ON	ON	OFF	ON	ON
Tandy 1000 SX	7	59357	OFF	ON	ON	ON	ON	OFF	ON	ON
Tandy 1000 TX	8	59357	OFF	ON	OFF	ON	ON	OFF	ON	ON
Tandy 1000 SL	8	59357	OFF	ON	OFF	ON	ON	OFF	ON	ON
Tandy 1000 TL	8	59357	OFF	ON	OFF	ON	ON	OFF	ON	ON
Tandy 1000 SL/2	8	59357	OFF	ON	OFF	ON	ON	OFF	ON	ON
Tandy 1000 TL/2	8	59357	OFF	ON	OFF	ON	ON	OFF	ON	ON
Tandy 1000 RL	8	59357	OFF	ON	OFF	ON	ON	OFF	ON	ON
Tandy 1000 TL/3	8	59357	OFF	ON	OFF	ON	ON	OFF	ON	ON

Please make sure the proper module for the switch settings you will be using is installed at U13. See **APPENDIX A** regarding the NOTE column for technical details of the configurations in the table.

STEP FOUR: Switch Settings for the Xtra-K EMS ISAcard
To use the information in the following table, you must be adding a minimum of 1MB of EMS and have a minimum of 640KB of conventional memory. The settings are used regardless of what video adapter is installed in your computer.

COMPUTER	NOTE	MODULE	1	2	3	4	5	6	7	8
IBM PC, XT NO	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
IBM AT, AT Compatible	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 SX	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 TX	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 SL	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 TL	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 SL/2	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 TL/2	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 RL	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 TL/3	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Tandy 1000 RLX	9	59357	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF

Please make sure the proper module for the switch settings you will be using is installed at U13. See **APPENDIX A** regarding the NOTE column for technical details of the configurations in the table.

STEP FIVE: Use the Appropriate Decode Module
Locate component U13 on the Xtra-K EMS-Plus ISAcard. You will find a decode module already installed in to a socket. The decode module will have a label with the following information on it:

component#/module#-revision/checksum

All tables in this manual refer to the part# regardless of the other information on top of the module to be used.

Example: If the module# does not agree with the MODULE column for your PC, you will need to change the decode module currently in your Xtra-K card.

To remove a decode module from the Xtra-K EMS-Plus ISAcard use a small screwdriver to gently pry the module from the socket. Be careful not to accidentally attempt to pry the socket off the circuit board. Place the decode module in protective foam packing as soon as possible.

To install a different decode module identify which end of the module has a notch to distinguish one end of the module from the other. Remove the different decode module from its protective foam packing.

Gently insert the decode module into the socket U13 on the circuit board. Be certain that the notch on the module aligns with the notch in the U13 socket and the printing on the circuit board below the socket. Be careful that you do not accidentally bend a pin underneath the module while inserting it.

STEP SIX: Physically Install the Board
Remove the cover from your PC. Locate an available ISA (Industry Standard Architecture) expansion slot. The Xtra-K cards will work in any 8-bit or 16-bit ISA slot even though only an 8-bit slot is required.

Firmly insert the board into the ISA slot.

Re-install the cover to your PC.

STEP SEVEN: Installing the Software for UMB Support
If you have installed an Xtra-K EMS-Plus ISAcard that is configured to provide UMB memory, you must install software so DOS can allow programs to use the UMB memory. If the Xtra-K ISAcard you purchased is unable to provide UMB support on your computer, skip to Step Eight.

Software is provided to allow Microsoft DOS 5.0 (or equivalent) to allow programs to use the UMB memory. If you do not use DOS 5.0, you may either upgrade your current DOS to DOS 5.0 or look into after-market memory management software. PC Enterprises makes no claim that any other after-market memory management software will be compatible with any of your hardware or software.

If you currently use Microsoft DOS 5.0 and have installed an Xtra-K EMS-Plus ISAcard that is configured to provide UMB memory, you must install software to allow programs to use it. The UMB-XK.SYS is necessary to allow DOS 5.0 to use the upper memory block. If you are not using DOS 5.0, do not use UMB-XK.SYS and refer to the section titled, "Installing the Software for EMS Support" later in this document.

UMB-XK.SYS is the Xtra-K ISAcard's counterpart to DOS 5.0's EMM386.EXE. The UMB-XK.SYS driver will make UMB memory available using your Xtra-K EMS-Plus ISAcard. Unlike EMM386.EXE, UMB-XK.SYS does not require a 386 processor, extended memory, or the HIMEM.SYS driver (no XMS memory support required).

After the UMB-XK.SYS driver provides UMB support, programs may take advantage of the UMB memory. In order to have UMB memory available to the greatest number of programs, be sure UMB-XK.SYS is installed before other programs and device drivers you want to use UMB memory.

Use the COPY command to copy the UMB-XK.SYS and EMS-XK.SYS files from the diskette that accompanied the Xtra-K EMS-Plus ISAcard to the disk that you will be booting from.

If the Xtra-K EMS-Plus ISAcard is configured to provide UMB and EMS memory, the example below will show you what to type in order to install the UMB and the EMS software in your CONFIG.SYS:

```
COPY CON CONFIG.SYS   [press Enter]
DEVICE=UMB-XK.SYS   [press Enter]
DEVICEHIGH=EMS-XK.SYS   [press Enter]
DOS=UMB   [press Enter]
[press F6 then Enter]
```

In order to operate DOS 5.0, making best use of the UMB memory now available, refer to the DEVICEHIGH, LOADHIGH, and MEM commands in your DOS 5.0 manual.

Notes on UMB-XK.SYS Version 1.0

Version 1.0 of PC Enterprises' UMB-XK.SYS software is not compatible with the HIMEM.SYS provided with DOS 5.0 and Microsoft Windows. If your computer has a 286 processor and you need to use HIMEM.SYS, please contact PC Enterprises for advice.

The UMB-XK.SYS program assumes you will be using E000-EFFF for UMB memory. If you are using D000-DFFF for UMB memory you will need to use the
/D000-DFFF parameter. If the switch settings shown in the tables for your computer reference notes 4 or 6, use the /D000-DFFF parameter.

STEP EIGHT: Installing Only the Software for EMS Support
In order for your programs to recognize any SIMMs installed in your Xtra-K card, you must install the LIM EMS 4.0 software driver.

If you do not have the Xtra-K EMS-Plus ISAcard, do not use DOS 5.0, or you have a computer that permits the Xtra-K EMS-Plus ISAcard to provide UMB memory, do not complete this step. Your computer permits the use of UMB memory when you use the switch settings associated with notes 2, 4, 6, or 9.

The EMS-XK.SYS driver allows the memory provided by SIMMs installed in the Xtra-K cards to be used as LIM EMS 4.0 memory. After the EMS-XK.SYS driver is loaded, programs, including other device drivers in your CONFIG.SYS file, can use EMS memory.

Use the line:

```
DEVICE=EMS-XK.SYS
```

in your CONFIG.SYS file. The EMS driver does not necessarily need to be the first device driver loaded, but it should load before any other program that uses EMS memory.

Use the COPY command to copy the EMS-XK.SYS file from the diskette that accompanied the Xtra-K ISAcard to the disk that you will use to boot your computer.

The example below shows how to install the EMS software in your CONFIG.SYS:

```
COPY CON CONFIG.SYS [press Enter]
DEVICE=EMS-XK.SYS  [press Enter]
[press F6 then Enter]
```

Notes on using DOS 5.0 with your Xtra-K card

The following programs can use EMS memory. You may find these programs very useful, however you must specify that they use EMS memory at the time they are run: SMARTDRV.SYS, RAMDRIVE.SYS, and FASTOPEN.

The following programs are TSR programs that will use conventional memory. You may find UMB memory very useful when using these programs: APPEND, ASSIGN, DOSKEY, FASTOPEN, GRAFTABL, GRAPHICS, JOIN, KEYB, MIRROR, MODE, MOUSE, NLSFUNC, PRINT, SHARE, SUBST, ANSI.SYS, DISPLAY.SYS, DRIVER.SYS, EGA.SYS, EMS-XK.SYS, MOUSE.SYS, PRINTER.SYS, RAMDRIVE.SYS, SETVER.EXE, SMARTDRV.SYS, and VDISK.SYS

Before any UMB memory can be used by DOS 5.0 it is imperative that you specify the DOS=UMB directive in your CONFIG.SYS file. It is also imperative that you specify DEVICE=UMB-XK.SYS so that DOS 5.0 will use the Xtra-K EMS-Plus ISAcard for UMB memory.

TSR programs can be in the form of executable files that you run from the DOS command prompt or device drivers loaded with the DEVICE= directive in your CONFIG.SYS file. To allow a program to load in UMB memory with DOS 5.0, use the command LOADHIGH on the command line before the name of the program as you would normally use it. For example, if you normally use the MODE command to initialize your COM1: port, you might use:

```
LOADHIGH MODE COM1:24,N,8,1
```

If you normally use a device driver named MOUSE.SYS in your CONFIG.SYS file to use a mouse input device, to load MOUSE.SYS into UMB memory you might use the following lines in your CONFIG.SYS:

```
DOS=UMB
DEVICE=UMB-XK.SYS
DEVICEHIGH=MOUSE.SYS
```

APPENDIX A: INSTALLATION NOTES

This section give technical details of what features are used for each of the switch settings given in the tables.

N.A. **Note 1:** With this configuration you will gain EMS memory, and an additional 64KB of conventional memory.

The EMS physical page frame is located at addresses E000-EFFF. The computer will have BIOS support for 704KB of conventional memory. The Xtra-K EMS-Plus ISAcard will not provide TGA or THGA backfilling. The Xtra-K EMS-Plus ISAcard will provide memory in the future video area for 704KB of conventional memory. The Xtra-K EMS-Plus ISAcard will not provide UMB memory.

Note 2: With this configuration you will gain EMS memory, an additional 64KB of conventional memory, and 64KB of UMB memory.

The EMS physical page frame is located at addresses D000-DFFF. The computer will have BIOS support for 704KB of conventional memory. The Xtra-K EMS-Plus ISAcard will not provide TGA or THGA backfilling. The Xtra-K EMS-Plus ISAcard will provide memory in the future video area for 704KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide UMB memory at E000-EFFF.

Note 3: With this configuration you will gain EMS memory, an additional 64KB of conventional memory, and any conventional memory previously used for TGA or THGA (on Tandy PCs only). PC Enterprises plans to make more decode modules available in the future. A future decode module may be available to allow the Xtra-K EMS-Plus ISAcard to provide the addition of 64KB of UMB memory for your PC.

The EMS physical page frame is located at addresses D000-DFFF. The computer will have BIOS support for 704KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide TGA or THGA backfilling on Tandy PCs using TGA or THGA. The Xtra-K EMS-Plus ISAcard will provide memory in the future video area for 704KB of conventional memory. The Xtra-K EMS-Plus ISAcard will not provide UMB memory.

✓ **Note 4:** With this configuration you will gain EMS memory, and an additional 64KB of UMB memory.

The EMS physical page frame is located at addresses E000-EFFF. The computer will have normal system board BIOS support for conventional memory. The Xtra-K EMS-Plus ISAcard will not provide TGA or THGA backfilling. The Xtra-K EMS-Plus ISAcard will not provide memory in the future video area. The Xtra-K EMS-Plus ISAcard will provide UMB memory at D000-DFFF.

Note 5: With this configuration you will gain only EMS memory. Pending the success of new software currently under development, the

Xtra-K EMS- Plus ISAcard may be able to also provide an additional 64KB of UMB memory for your PC.

The EMS physical page frame is located at addresses D000-DFFF. The computer will have normal system board BIOS support for conventional memory. The Xtra-K EMS-Plus ISAcard will not provide TGA or THGA backfilling. The Xtra-K EMS-Plus ISAcard will not provide memory in the future video area. The Xtra-K EMS-Plus ISAcard will not provide UMB memory.

Note 6: With this configuration you will gain EMS memory, an additional 96KB of conventional memory, and 64KB of UMB memory.

The EMS physical page frame is located at addresses E000-EFFF. The computer will have BIOS support for 736KB of conventional memory. The Xtra-K EMS-Plus ISAcard will not provide TGA or THGA backfilling. The Xtra-K EMS-Plus ISAcard will provide memory in the future video area for 736KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide UMB memory in the D000-DFFF area.

Note 7: With this configuration you will gain EMS memory, an additional 96KB of conventional memory, and any conventional memory previously used for TGA or THGA (on Tandy PCs only). Pending the success of new software currently under development, and the release of a new decode module, the Xtra-K EMS-Plus ISAcard may be able to also provide an additional 64KB of UMB memory for your PC.

The EMS physical page frame is located at addresses E000-EFFF. The computer will have BIOS support for 736KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide TGA or THGA backfilling on Tandy PCs using TGA or THGA. The Xtra-K EMS-Plus ISAcard will provide memory in the future video area for 736KB of conventional memory. The Xtra-K EMS-Plus ISAcard will not provide UMB memory.

Note 8: With this configuration you will gain EMS memory, an additional 96KB of conventional memory, and any conventional memory previously used for TGA or THGA (on Tandy PCs only). Pending the success of new software currently under development, and the release of a new decode module, the Xtra-K EMS-Plus ISAcard may be able to also provide an additional 64KB of UMB memory for your PC.

The EMS physical page frame is located at addresses D000-DFFF. The computer will have BIOS support for 736KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide TGA or THGA backfilling on Tandy PCs using TGA or THGA. The Xtra-K EMS-Plus ISAcard will provide memory in the future video area for 736KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide no UMB memory.

NO **Note 9:** With this configuration you will gain only EMS memory.

The EMS physical page frame is located at addresses D000-DFFF. The computer will have normal system board BIOS support for conventional memory. The Xtra-K EMS-Plus ISAcard will not provide TGA or THGA backfilling. The Xtra-K EMS-Plus ISAcard will not provide memory in the future video area. The Xtra-K EMS-Plus ISAcard will provide no UMB memory.

If your computer uses the D000-DFFF area for another adapter card, you may change switch 3 from OFF to ON to change the location of the EMS physical page frame from D000-DFFF to E000-EFFF.

NO

Note 10: With this configuration you will gain EMS memory, and an additional 64KB of conventional memory. The Xtra-K EMS-Plus ISAcard may be able to also provide an additional 64KB of UMB memory for your PC. Use the switch settings for "IBM PC, XT" to see if your PC is capable of allowing the UMB.

The EMS physical page frame is located at address D000-DFFF. The computer will have BIOS support for 704KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide memory in the future video area for 704KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide no UMB memory.

Note 11: With this configuration you will gain EMS memory, and an additional 96KB of conventional memory. The Xtra-K EMS-Plus ISAcard may be able to also provide an additional 64KB of UMB memory for your PC. Use the switch settings for "IBM PC, XT" to see if your PC is capable of allowing the UMB.

The EMS physical page frame is located at address D000-DFFF. The computer will have BIOS support for 736KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide memory in the future video area for 736KB of conventional memory. The Xtra-K EMS-Plus ISAcard will provide no UMB memory.

APPENDIX B: EXPERIENCED USERS' GUIDE TO INSTALLATION

The Xtra-K EMS-Plus ISAcard provides all the features of the Xtra-K EMS ISAcard, but also adds the capabilities of having more than 640KB of conventional DOS memory, an extra 64KB of UMB memory, and the ability to expand 512KB computers to 640KB.

The design of the Xtra-K cards allow different decode modules to be installed. Each decode module will allow the Xtra-K card to select a different combination of memory locations to use for its features. If the current decode modules included with your Xtra-K card do not suit your particular PC, contact PC Enterprises for the appropriate decode module and switch settings for your particular PC.

The Xtra-K cards were designed for fast zero wait state memory access. A wait state switch has been incorporated into the design of the Xtra-K cards to allow for future compatibility. PC Enterprises recommends that 100ns (or faster) SIMMs be used in the Xtra-K ISAcards. You may use SIMMs that have faster access time ratings than 100ns, however faster SIMMs should not provide any advantage.

Use only 256KBx8, 256KBx9, 1MBx8, 1MBx9, 4MBx8, 4MBx9, 16MBx8, and 16MBx9 size SIMMs. When used in the Xtra-K card, a "x9" offers no advantage over its "x8" counterpart.

The Xtra-K card will automatically detect which sockets hold SIMMs and what size each are.

Use the jumper located on J2 of the Xtra-K EMS-Plus ISAcard to set where the Xtra-K EMS-Plus ISAcard ROM code should reside.

Use the tables in step THREE or FOUR to determine which decode module should be installed into socket U13 on the board and how the switches should be set.

Physically install the board into your PC.

If you are using Xtra-K EMS-Plus ISAcard, install the UMB-XK.SYS driver in your CONFIG.SYS file. The UMB-XK.SYS driver allows DOS 5.0 to recognize UMB memory. Be certain to also include the DOS=UMB directive in your CONFIG.SYS file. DOS 5.0 will not use UMB memory without this directive.

Install the EMS-XK.SYS driver in your CONFIG.SYS file. The EMS-XK.SYS file provides LIM EMS 4.0 support.

EMS-XK.SYS

Below is the command line format of the EMS-XK.SYS driver. It includes the driver's optional parameters in brackets. This information is not intended as an example.

```
DEVICE=EMS-XK.SYS [/LONGTEST] [/REFRESHTEST] [/NOTEST]
```

The EMS-XK.SYS driver provides the LIM EMS 4.0 support for the Xtra-K EMS-Plus ISAcard and the Xtra-K EMS ISAcard. It will automatically detect the location of the EMS physical page frame.

/LONGTEST runs a thorough test on the Xtra-K's memory. Use this feature to help diagnose problems. Since this test takes extra time to execute, you may not always want to use this option (unless you are patient).

/REFRESHTEST is also used to help diagnose problems. Use it in addition to /LONGTEST to get the most thorough diagnostic results.

/NOTEST prevents the EMS-XK.SYS device driver software from performing its normal test on the system's RAM.

UMB-XK.SYS

Below is the command line format of the UMB-XK.SYS driver. It includes the driver's optional parameters in brackets. This information is not intended as an example.

```
DEVICE=UMB-XK.SYS [/A000-AFFF] [/A000-B7FF] [/B000-B7FF] [/D000-DFFF]
[/E000-EFFF] [/D000-EFFF]
```

UMB-XK.SYS is the Xtra-K EMS-Plus ISAcard counterpart to DOS 5.0's EMM386.EXE program. It allows some of the Xtra-K EMS-Plus ISAcard memory to be used as DOS 5.0 UMB memory.

UMB-XK.SYS will automatically assume the Xtra-K EMS-Plus ISAcard's UMB memory is in locations E000-EFFF. If your Xtra-K EMS-Plus ISAcard is configured to provide UMB memory at any other location, it must be specified with the DEVICE=UMB-XK.SYS command line.

The UMB-XK.SYS driver will always automatically test the UMB memory before allowing DOS to use it.

DOS 5.0's EMM386.EXE provides the UMB memory while DOS 5.0's HIMEM.SYS driver is responsible for managing the use of the UMB memory. UMB-XK.SYS takes the place of HIMEM.SYS's UMB memory management features, but does not provide extended memory XMS or HMA support.

/A000-AFFF allocates 64KB of UMB memory at this location. In most cases you will not ever need to use this parameter, however it has been included for factory test reasons. Do not use this parameter if you have a VGA or EGA display adapter.

/A000-B7FF allocates 96KB of UMB memory at this location. In most cases you will not ever need to use this parameter because this block of memory, if available on your computer, can be better utilized as conventional memory. If a software conflict requires that you limit conventional memory to 640KB, this parameter allows you to use the memory above 640KB as UMB memory. Do not use this parameter if you have a VGA or EGA display adapter.
Do not use this parameter if you have a VGA, EGA, HGA, THGA, MGA, or MDA display adapter.

/B000-B7FF allocates 32KB of UMB memory at this location. In most cases you will not ever need to use this parameter because this block of memory, if available on your computer, can be better utilized as conventional memory. If a software conflict requires that you limit conventional memory to 704KB, this parameter allows you to use the memory above 704KB as UMB memory. Do not use this parameter if you have a VGA or EGA display adapter. Do not use this parameter if you have a VGA, EGA, HGA, THGA, MGA, or MDA display adapter.

✓ **/D000-DFFF** allocates 64KB of UMB memory at this location. This parameter is used when the Xtra-K EMS-Plus ISAcard is configured to

USING

use D000-DFFF for UMB memory. D000-DFFF is generally unused by most PCs.

/E000-EFFF forces the UMB-XK.SYS driver to allocate 64KB of UMB memory at this location. E000-EFFF is the default location for UMB-XK.SYS to check for UMB memory. This parameter does not normally need to be specified.

/D000-EFFF forces the UMB-XK.SYS driver to allocate 128KB o36Xmemorysnm memory at this location. 128KB of UMB memory can only be possible if you are using no EMS memory and have an Xtra-K EMS-Plus ISAcard installed with the appropriate d switch settings in place.

Below are two examples of what should be included in your CONFIG.SYS file:

EMS support only:

```
DEVICE=EMS-XK.SYS
```

EMS and UMB support with UMB at E000-EFFF (DOS 5.0 required):

```
DOS=UMB
DEVICE=UMB-XK.SYS
DEVICEHIGH=EMS-XK.SYS
```

This example uses the DEVICEHIGH command introduced with DOS 5.0 to load the EMS driver in UMB memory for optimal memory utilization. Also, due to the fact that E000-EFFF is the default UMB area, the /E000-EFFF parameter not required.

EMS and UMB support with UMB at D000-DFFF (DOS 5.0 required):

```
DOS=UMB
DEVICE=UMB-XK.SYS /D000-DFFF
DEVICEHIGH=EMS-XK.SYS
```

Due to the fact that E000-EFFF is the default UMB area, the /D000-DFFF parameter must be used.

APPENDIX C: SWITCH DEFINITIONS

1	Xtra-K Memory Wait State
ON	Add wait states
[✓ OFF]	No wait states added

2	3	EMS Physical Page Frame Addresses
[✓ OFF]	[✓ OFF]	No physical page frame decoded
OFF	ON	CC00-DBFF
ON	OFF	D000-DFFF
[✓ ON]	[✓ ON]	E000-EFFF FOR EMS:

4	5	DOS/BIOS Conventional Memory Support
[✓ OFF]	[✓ OFF]	Normal system board BIOS (no Xtra-K intervention)
OFF	ON	640KB
ON	OFF	704KB
ON	ON	736KB

WITH EMS & UMB

6	7	8	EMS-Plus Memory Decode (module #59357)
OFF	OFF	OFF	No decode
OFF	OFF	ON	8000-9FFF (640KB)
OFF	ON	OFF	8000-AFFF (704KB)
OFF	ON	ON	8000-B7FF (736KB DOS)
[✓ ON]	[✓ OFF]	[✓ OFF]	D000-DFFF (64KB UMB)
ON	OFF	ON	A000-B7FF (736KB DOS), D000-DFFF (64KB UMB)
ON	ON	OFF	A000-AFFF (704KB DOS)
ON	ON	ON	A000-B7FF (736KB DOS)

BEST ALL AROUND

6	7	8	EMS-Plus Memory Decode (module #59368) NOT RECOMMENDED
OFF	OFF	OFF	No decode
[✓ OFF]	[✓ OFF]	[✓ ON]	D000-EFFF (128KB UMB)
OFF	ON	OFF	A000-AFFF (704KB DOS), E000-EFFF (64KB UMB)
OFF	ON	ON	A000-B7FF (736KB DOS), E000-EFFF (64KB UMB)
ON	OFF	OFF	D000-DFFF (64KB UMB)
ON	OFF	ON	E000-EFFF (64KB UMB)
ON	ON	OFF	A000-AFFF (704KB DOS)
ON	ON	ON	A000-B7FF (736KB DOS)

DeskMate Users: There have been unconfirmed reports that Tandy DeskMate version 3.05 and 3.51 will not run correctly when DOS reports more than 704KB of conventional memory. If you have the EMS-Plus ISAcard, and are operating with 736KB of conventional memory, you many need to limit conventional memory to 704KB in order to run DeskMate. To do this, switch 4 should be on and switch 5 should be OFF (4=ON and 5=OFF). If you find you must limit conventional memory to 704KB, the memory between 704KB and 736KB can be used as UMB memory (DOS 5.0 users only). To use this memory as a UMB your CONFIG.SYS file would look like this:

```
DOS=UMB
DEVICE=UMB-XK.SYS /B000-B7FF
DEVICEHIGH=EMS-XK.SYS
```